

INDOOR AND OUTDOOR COVERAGE OF THE TETRA RADIO COMMUNICATION NETWORK IN BELGIUM

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Review article

Abstract: Indoor and outdoor radio communication coverage is permanent issues for the emergency services in every country. In earlier times, every local service had its own communication network. Modern digital radio technology however offers a far better quality of communications and offers furthermore interoperability between different agencies.

In Belgium, the national authorities imposed a national tetra radio communications network for the emergency agencies, called the ASTRID (All round Semi-cellular Trunked Radio communication with Integrated Dispatching) network (Law, 1998).

But the users are becoming increasingly demanding as of the coverage of this network. Consequently, improving the radio coverage has become the biggest issue.

Key words: ASTRID, Coverage, Indoor coverage, Radio communications, Safety commission.

Introduction

The ASTRID tetra radio communications network is the Belgian network reserved for the emergency agencies. The NV A.S.T.R.I.D. was founded by law in 1998 to support the global security plan (Royal Decree, 1998).

In the management contract with the authorities for the NV A.S.T.R.I.D., 3 basic services were described to ensure the help and security services in Belgium: mobile radio communication, dispatching, paging and supporting services (Royal Decree, 1999 modified by Royal Decree, 2003). In this paper I only focus on the coverage issues of the radio communication.

Materials and methods

Coverage by the original management contract

The initial management contract imposed the NV A.S.T.R.I.D. to offer a minimum service of radio coverage. For a good understanding the minimum service was described as following:

- **Mobile coverage** for all mobile radios in vehicles on all roads across the Belgian Territory.
- **Indoor radio coverage** for portable radios in 208 of the 589 Belgian municipalities.
(namely the areas in those municipalities classified as “densely urbanised“ as defined by the National Geographic Institute).
- **Outdoor radio coverage** on street level for portable radios in 208 of the 589 Belgian municipalities.

(namely the areas in those communities classified as “less urbanised“ as defined by the National Geographic Institute).

- **Indoor radio coverage** for portable radios in prisons, sports stadia and National Airport Brussels - Zaventem.
- **Indoor radio coverage** for portable radios in areas defined as “highly developed industry” by the National Geographic Institute.
- **Indoor radio coverage** for portable radios in exhibition spaces, some concert halls and National Airports (buildings, parking lots).

The NV A.S.T.R.I.D. foresaw 435 base stations (transmitter masts) above ground and the necessary technical installations for specific places and buildings to comply with the directives of higher mentioned management contract.

Expansion of coverage by the business plan 2005 (approval Council of Ministries)

The expectations about coverage in the original management contract have to be seen in the actual spirit of time. Moreover, expectations as well as environmental conditions are changing.

In a world of fast evolving communication, the ASTRID users do formulate new needs and expectations. In 1998 we didn't even mention a spacious use of the mobile phone, since a few years however emergency services expect to have ASTRID coverage wherever they can use their mobile phone.

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Moreover is coverage an evolutionary item, attention should be paid to changing infrastructural (new buildings, hoods, etc.) and technological (new technologies, interference, etc.) circumstances.

To offer an answer for those changing circumstances and expectations the NV A.S.T.R.I.D. searched for a solution in his business plan of 2005:

- Shift the responsibility of indoor radio coverage for new building constructions and infrastructural works to the building owner. A recently established National Security Commission (Royal Decree, 2008) will decide if the owner, on his own expends, has to install an installation for indoor coverage. An act, ready to be signed by the Ministry of Interior, still has to be approved to get the Commission really started.
- To start up a new phase (block 3), wherefore with the Advisory Committee of users new criteria were drawn up, led in 2006 to a start of 79 new files for extra base stations.

Actual status of radio coverage

The actual situation is:

- All underground infrastructural works for the that time expected tunnels, parking lots, metros, etc. are realised in the mean time.
- For about 5 of the initially 435 above ground transmitter masts it took approximately 10 years to obtain the necessary construction license. The NIMBY (not in my back yard) syndrome does also play a role in the construction of a security network such as ASTRID.
- The 79 additional masts, except a few, are all operational. It takes mostly 2 years to install a new mast due to time finding a decent location and obtaining a building permit.

Strictly spoken, the NV A.S.T.R.I.D. deals with the minimal requirements of service (cfr. initial management contract). But the coverage as was planned and accomplished, however might has as consequence that there are still locations without or limited radio communication, as well outdoor as indoor. Due to the implementation of 435 masts there is though portable in- and/or outdoor coverage in a lot more than the 208 municipalities, but certainly not in all of the 589 municipalities. Coverage maps can confirm this (source NV A.S.T.R.I.D.).

Inventory of complaints, associated to the coverage of ASTRID, that users report, is made up and at regularly times discussed with the Advising Committee of users. The need of more coverage remains a recurring question from the user's side.

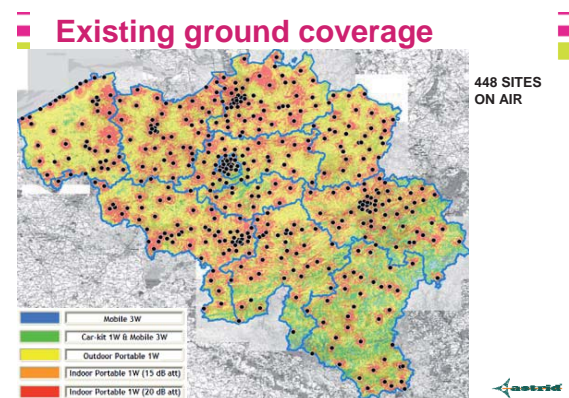


Fig. 1 Ground coverage map

The NV A.S.T.R.I.D. tries to make concessions to the needs of additional radio coverage in her new Business Plan for the coming 5 years. However, that plan - and the appropriate needs - still have to be validated by the Council of Ministers.

Results

Improving the indoor radio coverage by the instrument of the Security Commission

Because of the limited financial resources of the network owner (NV A.S.T.R.I.D.), and in order to improve the indoor coverage for the emergency services, a National Security Commission has been installed by a federal act.

However, a second act that determines the criteria of infrastructures within the scope of this act has still to be approved.

The security commission has to decide whether **new and big** infrastructures need extra indoor coverage. If so, these investments are on charge of the owner of the infrastructure.

An infrastructure is classified as **big** when satisfying to one of the following criteria:

- Accessible for the public and having a capacity of more than 150 persons (e.g. theatres).
- Underground spaces that are or accessible for public, whit the exception of sanitary blocs (e.g. parking lots) or destined for storage of dangerous goods as defined by a federal act (Royal Decree, 1993).
- Buildings with a ground surface of more than 2500 m² (e.g. supermarkets).

An infrastructure is classified as **new** when a request for a building permit is introduced for a new construction or for transformation or renovation of an existing construction.

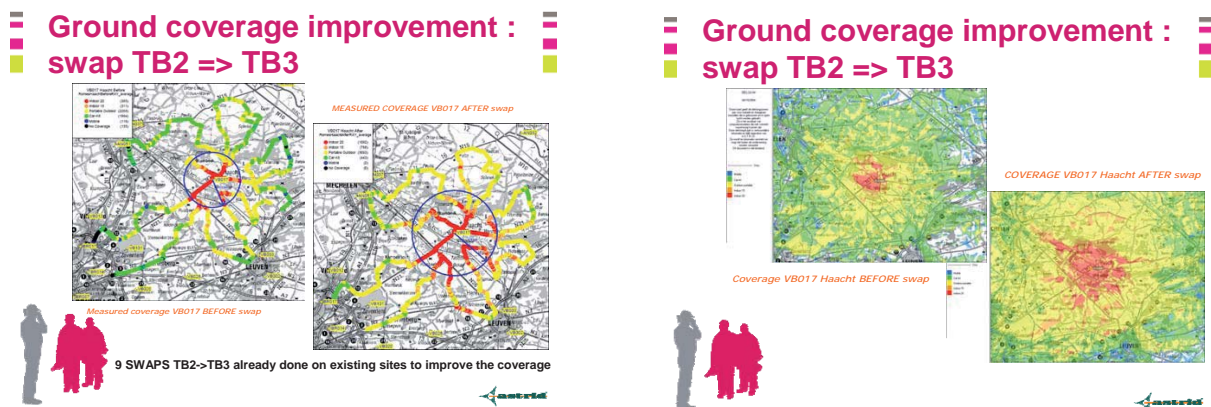


Fig. 2 Ground coverage improvement (source NV A.S.T.R.I.D.)

The National Security Commission will, based on a file send to the commission by the local authorities, decide whether the owner has or has not to install extra indoor coverage facilities.

If the owner has to do so, the obligation will be imposed in the building permit.

The building owner has free choice of the supplier to realise the design, installation and maintenance of the indoor coverage system, but the installation has to respond to the criteria imposed by the network owner (NV A.S.T.R.I.D.).

The design and later on the installation are validated by the network owner based on RF measurements in order to determine whether it complies with the emergency services operational needs.

The supervision and the remote monitoring of the active equipments are managed by the network owner 24/7.

The maintenance is under the responsibility of the building owner through his supplier.

Improving the indoor radio coverage by technical upgrades

The indoor (and obviously also the outdoor) coverage can also be improved by building new base stations, but the financial resources are limited. The expense of a new base station turns around € 200.000.

References

- Law 08/06/1998, about "Radio communications of the emergency services".
- Royal Decree 11/01/1993, about "Classification, packaging and branding for the use of dangerous goods".
- Royal Decree 27/06/1998, about "Statute of the NV A.S.T.R.I.D".
- Royal Decree 08/02/1999, about "Management contract of the NV A.S.T.R.I.D".
- Royal Decree 25/07/2008, about "Rules and operation of the ASTRID Security Commission and her mission".

As said higher up, 79 new base stations are now on air, which improve obviously the indoor coverage.

A less expensive solution however is to upgrade existing base stations with new antenna configurations (swap TB2 to TB3).

As shown in the examples below, the improvement of the range of indoor and outdoor radio coverage is significant.

Conclusion

An abstinent and reliable radio communication network for the emergency services is crucial. Indeed, the possibility that commercial networks fail in case of disasters is very realistic.

Therefore the commercial networks can only be used by the emergency services for non mission critical communications.

But a private network can, because of financial limitations, never offer the same possibilities of the commercial networks.

The biggest issue will always be indoor coverage.

In Belgium we try to improve the indoor coverage by implantation of new base stations (expensive and therefore limited), by upgrading existing base stations and by imposing extra coverage equipment to the owners of new and big infrastructures.